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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/836,286	04/18/2001	Hidetaka Nambu	Q62963	5457

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EXAMINER
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DEO, DUY VU NGUYEN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 04/07/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/836,286

Applicant(s)

NAMBU, HIDETAKA

Examiner

DuyVu n Deo

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 01 July 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☒ Claim(s) 20 are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 June 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4, 8.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

## DETAILED ACTION

### *Election/Restrictions*

1. Applicant's election without traverse of claims 1-19 in Paper No. 7 is acknowledged.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1 are rejected under 35 U.S.C. 102(e) as being anticipated by Ye et al. (US 6,080,529).

Ye describes a method for etching organic low dielectric constant (or low k) layer such as FLARE (polyarylene ether), and SILK using a gas comprising NH<sub>3</sub> (col. 9, lines 1-3, lines 33-46; col. 12, lines 18-32; col. 19, line 51-62; col. 22, line 40-42).

Referring to claim 2, Ye further describes steps: forming organic low k film on a substrate, forming a silicon dioxide (claimed silicon-containing insulating film or SiO<sub>2</sub>) on the low k film (col. 11, line 44-50; col. 21, line 44-45, 50-54; col. 22, line 22-25); removing a part of the silicon oxide to form a first opening (col. 11, line 57-60; col. 22, line 1, 26, 27; figures 2B, 4B); etching the organic low k film with the first opening as a first mask using a gas comprising NH<sub>3</sub> (col. 12, lines 18-32; col. 19, line 51-62; col. 22, line 40-42).

Referring to claim 11, Ye also teaches that when the above method is done to form contact hole or via in a damascene process, the method would further comprise forming a

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diffusion barrier to line the openings (claimed a first barrier metal on an entire inside surface of the hole); and forming a first conductive layer such as copper, tungsten, or aluminum on the barrier to fill the opening (col. 20, line 1-20).

Referring to claims 3, and 12 the etching gas additionally comprises a combination of N<sub>2</sub>, H<sub>2</sub>.

Referring to claims 5, 14 the organic low k film such as FLARE (polyarylene ether) and SILK would read on claimed hydrocarbon-based organic low k film.

Referring to claims 6, 15 the method further comprising a photoresist on the silicon dioxide; removing a part of the photoresist to form a second opening which is used as a second mask for the step of etching the silicon dioxide film (col. 11, line 52-col. 12, line 3; col. 22, line 26-28); wherein the photoresist is removed during the step of etching the organic low k film (col. 11, line 61-65; col. 12, line 38-40; line 49-53).

Referring to claims 7, 16 the aspect ratio is 4:1 which would be higher than 1.5. The aspect ratio includes the thickness of the silicon dioxide and the organic low k film (col. 21, line 60-62).

Referring to claims 8-10, the thickness of the organic is 0.8 micrometer (col. 11, line 48; col. 21, line 55), the thickness of the silicon dioxide is 0.1 or 0.2 micrometer (col. 11, line 49; col. 21, line 52), and since the opening size of the via is determined and controlled directly from the opening in the photoresist size (or second opening), and the dimension of the opening size of the via is 0.3 micrometers, therefore, the width dimension of the second opening would also be approximately 0.3 micrometers (read on claimed approximately but not less than 0.2 micrometers).

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Referring to claim 11, Ye also teaches that when the above method is done to form contact hole or via in a damascene process, the method would further comprise forming a diffusion barrier metal to line the openings (claimed a first barrier metal on an entire inside surface of the hole); and forming a first interconnect metal layer such as copper, tungsten, or aluminum on the barrier to fill the opening (col. 11, line 42, 43; col. 20, line 1-20).

***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 17-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ye as applied to claim 16 above, and further in view of Chiang et al. (US 5,817,572).

Referring to claims 17-19, the steps and limitations of these claims are the same as that of claims 11, 12 except that these steps are used to form another or upper interconnect level. Even though Ye is silent about forming an additional or upper interconnect level; however, it is well known to one skilled in the art that a semiconductor device has many structures or levels of interconnections. Chiang is used here to show that at least 2 levels of interconnections are formed within a semiconductor device (col. 5, line 40-61; figure 9). Chiang also describes that the additional interconnect level or upper level may be formed in a similar manner as that of the lower interconnect level (col. 5, line 58, 59). Therefore, it would have been obvious for one skilled in the art at the time of the invention in light of Chiang to repeat these steps in order to

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form another or upper level of interconnection for a semiconductor device with a reasonable expectation of success.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 703-305-0515.

DVD

April 4, 2003

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